(19)日本国特許庁（ＪＰ）　(12)**公開特許公報**（Ａ）　(11)特許出願公開番号

**特開平9－133687**

(43)公開日　平成９年(1997)５月20日

| (51)Int.Cl.[6] | | 識別記号 | 庁内整理番号 | ＦＩ | | 技術表示箇所 |
|---|---|---|---|---|---|---|
| Ｇ０１Ｎ | 35/10 | | | Ｇ０１Ｎ | 35/06 | Ｃ |
| Ｇ０１Ｆ | 23/28 | | | | 1/14 | Ａ |
| Ｇ０１Ｎ | 1/14 | | | | 33/48 | Ｊ |
| | 33/48 | | | | 35/02 | Ｇ |
| | 35/02 | | | Ｇ０１Ｆ | 23/28 | Ｌ |

審査請求　未請求　請求項の数５　ＦＤ　（全７頁）　最終頁に続く

(21)出願番号　特願平7－317079

(22)出願日　平成７年(1995)11月13日

(71)出願人　591108237
明治電機工業株式会社
愛知県名古屋市中村区亀島２丁目13番８号

(72)発明者　高橋　利匡
名古屋市中村区亀島二丁目13番８号　明治電機工業株式会社内

(72)発明者　伊藤　敏昭
名古屋市中村区亀島二丁目13番８号　明治電機工業株式会社内

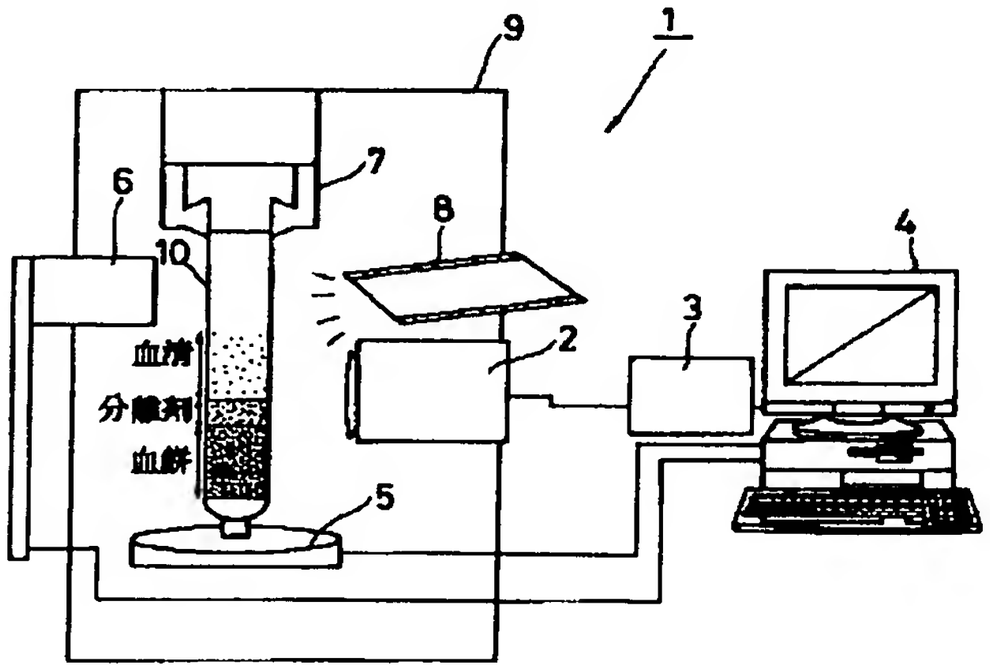
(74)代理人　弁理士　千田　稔

(54)【発明の名称】　採血試験管における血清量測定装置

(57)【要約】

【課題】　採血試験管内の血清量、血餅又は分離剤と血清との境界位置を正確にかつ迅速に測定する装置を安価に提供し、採血試験管から直接分注することを可能にすることを課題とする。

【解決手段】　カラーＣＣＤカメラ２を通して撮影された採血試験管１０の撮像情報から、パーソナルコンピュータ４にて画像処理を行ってＲＧＢ濃淡情報、色度情報、彩度情報を求め、彩度情報から血液成分のうち血清部分と他の部分との境界線位置を求め、更に、境界情報から採取可能な血清の量を計算することにより、採血試験管から無駄なく血清を採取可能にした。



【特許請求の範囲】

【請求項１】　採血試験管をカラー撮影して、該採血試験管のカラー撮像情報を得る手段と、
前記カラー撮像情報からカラー撮像の各画素においての赤、青、緑の濃淡情報を求める手段と、
前記濃淡情報から明度情報を取り除いて色度情報を求める手段と、
前記色度情報から彩度情報を求める手段と、
前記彩度情報から血液成分のうち血清部分と他の部分との境界線位置を求める手段と、
前記境界情報から採取可能な血清の量を計算する手段と、を含んで構成されたことを特徴とする採血試験管における血清量測定装置。

【請求項２】　前記採血試験管表面の検体ＩＤを示すバーコードラベルが貼られていない位置が撮影方向を向くように、採血試験管をセットする手段を含んで構成されたことを特徴とする請求項１記載の採血試験管における血清量測定装置。

【請求項３】　前記採血試験管をセットする手段は、
前記採血試験管を回転する回転手段と、
前記バーコードラベル位置を検出する光沢度センサと、
前記光沢度センサからの検出信号に基づいて前記回転手段を制御する制御手段と、を含んで構成されたことを特徴とする請求項２記載の採血試験管における血清量測定装置。

【請求項４】　前記彩度により求めた境界線位置近傍の画素の前後所定ドットに対して赤、青、緑各成分の画素の各ドットでの変化量を求め、変化量が最大となる位置を境界線位置とする手段を含んで構成されたことを特徴とする請求項１～３のうちいずれか１つに記載の採血試験管における血清量測定装置。

【請求項５】　前記撮影方向から見た採血試験管の後方に、採血試験管に略密着させて白系統の部材を置いて採血試験管を撮影するようにしたことを特徴とする請求項１～４のうちいずれか１つに記載の採血試験管における血清量測定装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、採血試験管における血清量測定装置に関し、詳しくは、例えば、分注器等により、遠心分離をかけた採血試験管から自動化学分析に必要な血清を採取するに際して、血清部分の量を予め測定する血清量測定装置に関する。

【０００２】

【従来の技術】採血試験管としての真空採血管に遠心分離をかけると、該採血管内において、血清部と血餅部の２層に分離され、分離剤を入れると、血清と分離剤と血餅の３層に分離される。

【０００３】このように各成分が分離された真空採血管からは、自動機により、化学分析に必要な血清部分のみ



を抜き取り、分注を行う。従来では、自動機により分注を行う場合は、真空採血管から別に用意したサンプル容器に血清部のみを移した後に、分注を行う方法が採られていたが、近年では、患者から採血する際に用いた真空採血管自体をサンプル容器として用い、この真空採血管から直接血清部分を採取することが多くなっている。この場合、真空採血管の底部には血餅が沈澱し、分離剤を用いた場合は、この分離剤が血清と血餅との間に残存するようになり、これにより血清と血餅とが真空採血管内において分離される。

【０００４】

【発明が解決しようとする課題】しかしながら、上記のように真空採血管から直接的に分注を行う場合、分析に必要な血清のみを所定量サンプリングするのが難しいという問題点がある。例えば、分注の際、血清量が充分確保できていない採血管の場合、分注ノズルが血餅又は分離剤の深さまで到達してしまうことになり、分析に必要な血清以外の成分まで吸引してしまうため、前記分注ノズルを詰まらせる虞がある。

【０００５】このため、真空採血管から別に用意したサンプル容器に血清部分のみを移した後に、分注を行うという以前の方法を採らざるを得ない場合がある。このような問題を解決するには、真空採血管から直接分注を行う場合に、遠心分離がかけられた真空採血管内の血清部分の容量を分注前に正確に計測することができれば良く、これが実現すれば、限られた血清量を必要な分析・検査の優先順位の順に割り当て、採血量が少ない患者の血清を有効に利用することが可能となる。

【０００６】このような考え方から、従来では、採血試験管内の血清量を測定する方法が次のように提案されている。例えば、採血試験管内に各成分の境界を検出するセンサ（界面検知センサ）を挿入し、血餅又は分離剤の位置を検出する方法が提案されている。この場合のセンサの種類は種々提案されており、例えば特開昭５３－７１８９７号公報には、超音波の送受信器を用いた技術が開示され、又、特開昭５３－１１６１９０号公報等には、光ファイバを用いた技術が開示されている。

【０００７】又、電極を挿入し、抵抗値差やインピーダンス差を用いた技術も提案されている。以上のセンサを用いて、血餅又は分離剤の位置を検出する方法では、血清内にセンサを挿入する必要があり、特に、分析に使用する場合は、前サンプルの血清が後のサンプルに混入することを防止するために、１回の採取毎にセンサを充分に洗浄し、又、洗浄後の混入を防止するために洗浄後の乾燥の必要も生じる。又、装置の保守の際等にセンサに触れると、患者の血液からの感染の可能性もあり、危険である。

【０００８】又、かかる従来の測定方法では、設備の規模が大掛かりで、設備投資に多大な費用が掛かると共に、採血試験管１本にかかる界面位置検出時間が長く掛

かるという問題点もある。

【０００９】更に、試験管を透過する光により、各成分の境界を検出する方法が提案されている。例えば、試験管の外の一方の光源からの光を、試験管を透過させ受光部で受け取り、透過光量変化や光の波長により透過率が異なる特性を求める等により境界を認識する方法が幾つか提案されている。（特開平２－４０５３９、特開平２－３８９６８号公報及び特開平１－４４４６４号公報参照）。

【００１０】ところで、真空採血管の表面には、検体ＩＤを示すバーコードラベルを設けるようにした検体ＩＤ方式が採用され、これによって、検体取り扱いミスの防止及び測定の合理化等が図られているが、上記の方法を真空採血管での血清量測定に適用するためには、真空採血管の表面に貼られた検体ＩＤを示すバーコードラベルを取り除くか、バーコードラベルの貼られていない位置での透過検出のみに限定する必要があり、真空採血管からの血清量測定の方法として適さない。

【００１１】そこで、本発明は上記に鑑みてなされたものであり、血清内にセンサを挿入することなく、かつ例えば採血試験管の表面に検体ＩＤを示すバーコードラベルが貼られた状態であっても、血清量、血餅又は分離剤と血清との境界位置を正確にかつ迅速に測定する装置を安価に提供し、採血試験管から直接分注することを可能にすることを課題とする。

【００１２】

【課題を解決するための手段】このため、請求項１に係る発明は、採血試験管をカラー撮影して、該採血試験管のカラー撮像情報を得る手段と、前記カラー撮像情報からカラー撮像の各画素においての赤、青、緑の濃淡情報を求める手段と、前記濃淡情報から明度情報を取り除いて色度情報を求める手段と、前記色度情報から彩度情報を求める手段と、前記彩度情報から血液成分のうち血清部分と他の部分との境界線位置を求める手段と、前記境界情報から採取可能な血清の量を計算する手段と、を含んで構成した。

【００１３】請求項２記載の発明は、前記採血試験管表面の検体ＩＤを示すバーコードラベルが貼られていない位置が撮影方向を向くように、採血試験管をセットする手段を含んで構成した。

【００１４】請求項３記載の発明は、前記採血試験管をセットする手段は、前記採血試験管を回転する回転手段と、前記バーコードラベル位置を検出する光沢度センサと、前記光沢度センサからの検出信号に基づいて前記回転手段を制御する制御手段と、を含んで構成した。

【００１５】請求項４記載の発明は、前記彩度により求めた境界線位置近傍の画素の前後所定ドットに対して赤、青、緑各成分の画素の各ドットでの変化量を求め、変化量が最大となる位置を境界線位置とする手段を含んで構成した。



【００１６】請求項５記載の発明は、前記撮影方向から見た採血試験管の後方に、採血試験管に略密着させて白系統の部材を置いて採血試験管を撮影するようにした。

【００１７】

【発明の実施の形態】以下、本発明の実施形態を図面に基づいて詳述する。先ず、本発明の原理について説明する。血液が遠心分離法によって各成分毎に分離された場合、各成分は夫々独自の色を呈する。この色の相違をカラー画像から取り込んだ赤、緑、青（ＲＧＢ）の濃淡情報から認識することによって、血液成分のうち血清部分と他の部分との境界を認識し、これから血清量を求める。

【００１８】本発明者らは遠心分離後の採血試験管のカラー画像を分析した。この結果、ＲＧＢの濃淡情報から明度情報を取り除いた色度情報（ＲＧＢの平均値に対するＲＧＢ各成分の混入比率）を求められ、この色度情報から求めた彩度値が血清部分で高い値を示すことが確認できた。

【００１９】これは、血清部分は透明度が高くて、鮮やかに画像として見える一方、血餅は黒っぽい色の固形物であり、画像上鮮やかさが低いことによる。又、分離剤も乳白色を呈し、血清部分に比べると、明らかに鮮やかさが低く見えるためである。これらのことは、血清の色が正常な血液が示す黄色のときだけでなく、赤色に近い血清の場合等も当てはまり、殆ど全ての採血管において、彩度の高い領域を認識することにより、血清部分の領域を計算できることになる。

【００２０】図１は、上述のような原理に基づく、本発明の血清量測定装置の一実施形態の具体的構成を示す図、図２は、この装置の制御内容を説明するフローチャートである。先ず、図１において、採血試験管の血清量測定装置１は、カラーＣＣＤカメラ（以下、単にカメラと言う）２と、ビデオ入力ボード３と、パーソナルコンピュータ４と、試験管回転用モータ（以下、単にモータと言う）５と、光沢度センサ（バーコードラベル位置検出用）６と、試験管チャック７と、画像撮影用照明８と、から構成されていおり、カメラ２、モータ５、光沢度センサ６、試験管チャック７及び照明８は、夫々測定暗箱９内に配設されている。

【００２１】ここで、前記カメラ２は、採血試験管１０をカラー撮影して、該採血試験管１０のカラー撮像情報を得る手段を構成する。又、前記パーソナルコンピュータ４は、前記カラー撮像情報からカラー撮像の各画素においての赤、青、緑（ＲＧＢ）の濃淡情報を求める手段、前記ＲＧＢ濃淡情報から明度情報を取り除いて色度情報を求める手段、前記色度情報から彩度情報を求める手段、前記彩度情報から血液成分のうち血清部分と他の部分との境界線位置を求める手段、前記境界情報から採取可能な血清の量を計算する手段、前記彩度により求めた境界線位置近傍の画素の前後所定ドットに対してＲＧ

Ｂ各成分の画素の各ドットでの変化量を求め、変化量が最大となる位置を境界線位置とする手段の各手段として機能をソフトウェア的に装備している。

【００２２】又、前記モータ５、光沢度センサ６及びパーソナルコンピュータ４は、採血試験管１０を回転させて該採血試験管１０表面の検体ＩＤを示すバーコードラベルが貼られていない位置が撮影方向を向くように、採血試験管１０をセットする手段を構成しており、パーソナルコンピュータ４は、光沢度センサ６からの検出信号に基づいて回転手段としての前記モータ５を制御する制御手段としての機能をソフトウェア的に装備している。

【００２３】かかる血清量測定装置１を用いた血清部分の量測定処理は次のように行う。即ち、採血試験管１０をカメラ２の前に置き、モータ５によって採血試験管１０を回転させてカメラ２の正面に検体ＩＤを示すバーコードラベルが貼られていない位置がくるようにする。

【００２４】この場合、バーコードラベルの貼り位置を検出することによって、逆にバーコードラベルが貼られていない位置を知るが、これは一般に用いられている方法であり、前記光沢度センサ６により容易に行うことができる。カメラ２の前にバーコードラベルが貼られていない位置の採血試験管１０が写っている時点で、採血試験管１０のカラー映像をビデオ入力ボードに取り込む。

【００２５】ビデオ入力ボード３の画像をビットマップ形式でパーソナルコンピュータ４に取込み、採血試験管画像の垂直方向の中心線から左右各８ドット各画素を認識用に抽出し、各画素においてのＲＧＢの濃淡情報に変換する。抽出する画素数は、本実施形態では左右８ドットを採用したが、認識計算の一例として採用したもので、本発明自体が左右８ドットに限定されるものではない。かかるＲＧＢの濃淡情報から、血清部分の液面位置及び血餅又は分離剤と血清部分との境界を認識計算する。

【００２６】次に、図２のフローチャートを参照して、上記の血清部分の量測定処理の詳細を、パーソナルコンピュータ４の制御内容に基づいて説明する。

【００２７】先ずステップ１（図では、Ｓ１と略記する。以下同様）においては、光沢度センサ６を用いて採血試験管の位置決めを行う。即ち、図３に示す認識領域の画像がバーコードラベル１１に重なり合うことなく取り込めるように、光沢度センサ６を用いてバーコードラベルのない位置を制御側に指令する。

【００２８】ステップ２においては、カメラ２で採血試験管１０の撮像情報を得る。即ち、パーソナルコンピュータ４は、光沢度センサ６の制御信号を受け取ったならば、カメラ２で採血試験管撮像情報をキャプチャーする。

【００２９】ステップ３においては、採血試験管情報をカメラ２からＮＴＳＣビデオ入力信号としてビデオ入力ボード３に送信する。



【００３０】ステップ４では、ビデオ入力ボード３からの情報を周知のビットマップ形式に変換する。

【００３１】ステップ５では、ビットマップフォーマット情報から各画素においてのＲＧＢ濃淡情報に変換する。

【００３２】ステップ６では、ＲＧＢ濃淡情報から、明度情報を取り除いた色度情報（ｒ，ｇ，ｂ）にする。

即ち、ｒ＝Ｒ／（Ｒ＋Ｇ＋Ｂ）

ｇ＝Ｇ／（Ｒ＋Ｇ＋Ｂ）

ｂ＝Ｇ／（Ｒ＋Ｇ＋Ｂ）

ｒ＋ｇ＋ｂ＝１　色度平面

とする。

【００３３】ステップ７では、彩度情報を求める。即ち、色度情報（ｒ，ｇ，ｂ）は、図４（Ａ）に示すように、同一平面上の点（ｒ＋ｇ＋ｂ＝１　色度平面）の集合となり、同図に示すような平面上の点から彩度を求めるようにする。彩度は、図４（Ｂ）において、ＷＰ／ＷＱの比で表す（参考文献　画像処理応用技術　工業調査会）。この場合、図４（Ｂ）の点Ｗは、正三角形の重心で無彩色を表す。点Ｐは、線分ＷＰの延長上の点と平面上の点ｒ＋ｇ＋ｂ＝１（ｒ≧０，ｇ≧０，ｂ≧０）の交点である。

【００３４】ステップ８では、境界線の認識を行う。即ち、血清部分は、彩度の値が他の部分よりも高いので、その部分を血清と認識する。これを詳述すると、彩度情報の取り込み開始位置から終端までの移動平均を求める。これをグラフに表すと図５のようになる。血清部分が必ず抽出できる規定値を決め、その規定値により決定されるレベルより上方の部分を血清部分として認識する。血清部分として認識した両端の画素の前後１５ドットを認識域として、その部分の｜$R_{n+1}$　－$R_n$　｜＋｜$G_{n+1}$　－$G_n$　｜＋｜$B_{n+1}$　－$B_n$　｜（図６のグラフ参照）の最大値を血清表面又は血清と分離剤の界面位置として検出する。

【００３５】以上の作用によって求められた血清境界情報に、撮影した採血試験管の種別を与えることにより、採血試験管の種別毎に採取可能な血清の容量を計算することができる。

【００３６】尚、かかる彩度情報に基づく血清量の認識では、使用する照明８を採血試験管１０の正面から当てることによって、採血試験管１０の半周以上にわたりバーコードラベル１１が貼られている場合でも、カメラ２の正面からみたとき、バーコードラベル１１の貼られていない隙間が約６ｍｍ以上あれば血清量の認識が可能である。

【００３７】又、彩度情報に基づき血清領域を認識する本構成では、反射光での撮影であり、バーコードラベルに印刷された文字、記号の影響を受けずに認識が可能である。

【００３８】更に、実際には、上記の各処理に加え、ビ

デオ画像から測定物の大きさを割り出すための距離補正処理を行うのが好ましい。かかる距離補正は、試験管画像と共に距離の定まった点（例えば、ＬＥＤ等）を撮影し、常時距離の補正を行うものであり、測定精度を保証するものである。

【００３９】かかる構成によると、カメラ２によるカラー画像から採血試験管１０内の血清容量及び血餅又は分離剤と血清との境界位置を認識する装置を用いることにより、患者から直接血液を採取した採血試験管１０で、バーコードラベルの貼られた状態のままで、血清量を正確に、分注前に得ることができるため、採取した血液のうち採取可能な血清量に応じて、より優先順位の高い分析・検査から血清を割り当てることが可能となり、貴重な血清の有効利用が可能となる。

【００４０】又、血清液面位置及び血餅又は分離剤と血清との境界位置を分注器に知らせることにより、センサを採血試験管１０内に挿入する必要がなく、よってセンサ洗浄等が不要な安全な分注器を容易に製作することができる。

【００４１】更に、かかる測定装置では、設備の規模が小さく、設備投資にかかる費用が少なくて済み、採血試験管１本にかかる界面位置検出時間も短いという利点がある。

【００４２】尚、上記の構成において、使用する採血試験管の種別は、取り込んだカラー画像から認識することも可能である。又、カメラ２から見た採血試験管１０の後方に、採血試験管１０に略密着させた白系統の部材、例えば白又は淡いグレーの紙又はプラスチックの物体を置くと、採血試験管画像でバーコードラベルの貼られた部分とバーコードラベルの貼られていない部分での血清画像の明度、彩度、色相の差が殆どない画像を得ることができ、バーコードラベルの影響を少なくする採血管の撮影とすることができる。

【００４３】

【発明の効果】以上説明したように、請求項１に係る発明によれば、血清量を正確に、分注前に得ることができるため、採取した血液のうち採取可能な血清量に応じて、より優先順位の高い分析・検査から血清を割り当てることが可能となり、貴重な血清の有効利用が可能となると共に、血清液面位置及び血餅又は分離剤と血清との境界位置を分注器に知らせることにより、センサを採血試験管内に挿入する必要がなく、よってセンサ洗浄等が



不要な安全な分注器を容易に製作することができ、しかも、設備の規模が小さく、設備投資にかかる費用が少なくて済み、採血試験管１本にかかる界面位置検出時間も短いという利点がある。

【００４４】請求項２に係る発明によると、患者から直接血液を採取した採血試験管で、検体ＩＤを示すバーコードラベルの貼られた状態のままで、血清量を正確に、分注前に得ることができる。

【００４５】請求項３に係る発明によると、バーコードラベルが貼られていない位置を光沢度センサで容易に検出でき、採血試験管の位置を適正に制御できる。

【００４６】請求項４に係る発明によると、彩度情報から血液成分のうち血清部分と他の部分との境界線位置をより正確に識別できる。

【００４７】請求項５に係る発明によると、採血試験管画像でバーコードラベルの貼られた部分とバーコードラベルの貼られていない部分での血清画像の明度、彩度、色相の差が殆どない画像を得ることができ、バーコードラベルの影響を少なくする採血管の撮影とすることができる。

【図面の簡単な説明】

【図１】　本発明の血清量測定装置の一実施形態の具体的構成を示す図

【図２】　同上装置の制御内容を説明するフローチャート

【図３】　認識領域の画像とバーコードラベルとの関係を示す図

【図４】　（Ａ）は色度情報を示す図、（Ｂ）は彩度を示す図

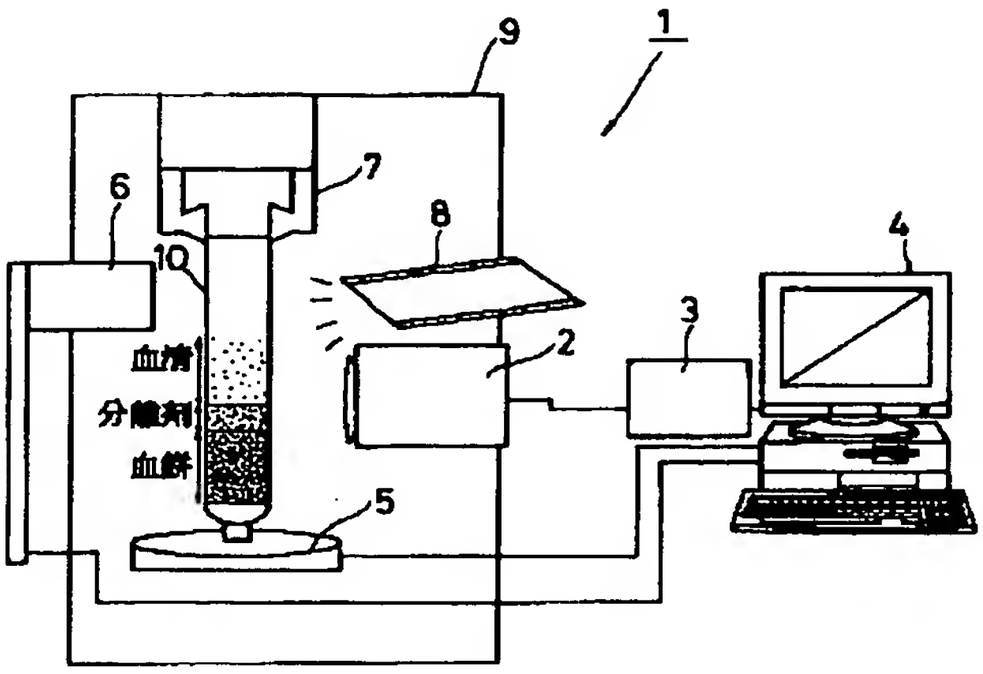
【図５】　彩度情報の取り込み開始位置から終端までの移動平均を表すグラフ

【図６】　$|R_{n+1}-R_n|+|G_{n+1}-G_n|+|B_{n+1}-B_n|$を表すグラフ

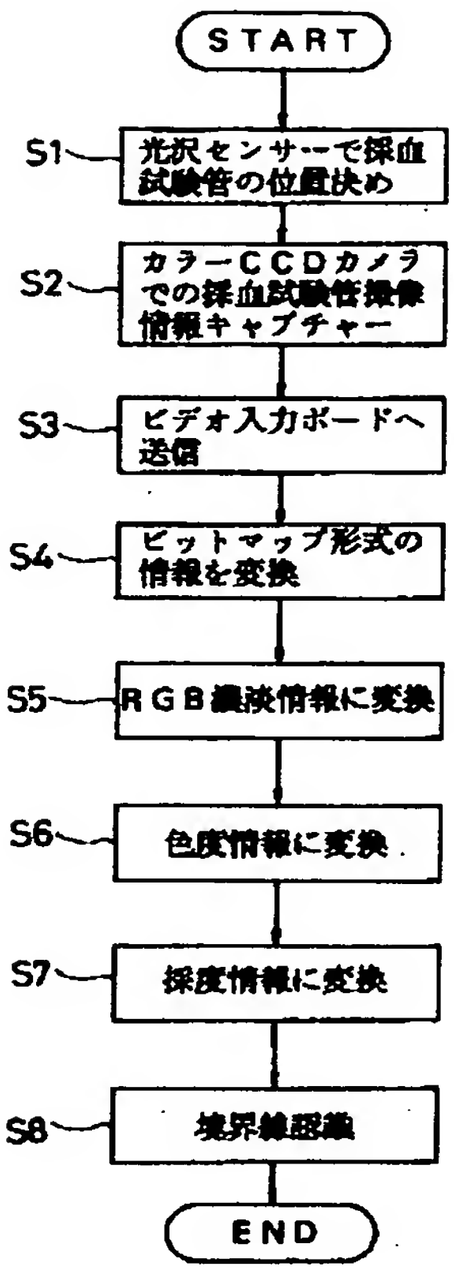
【符号の説明】

１　血清量測定装置
２　カラーＣＣＤカメラ
３　ビデオ入力ボード
４　パーソナルコンピュータ
５　試験管回転用モータ
６　光沢度センサ
１０　採血試験管
１１　バーコードラベル

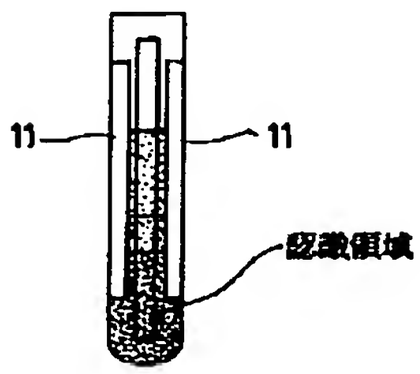
【図１】


9
1
6
7
8
10
4
3
2
血清
分離剤
血餅
5

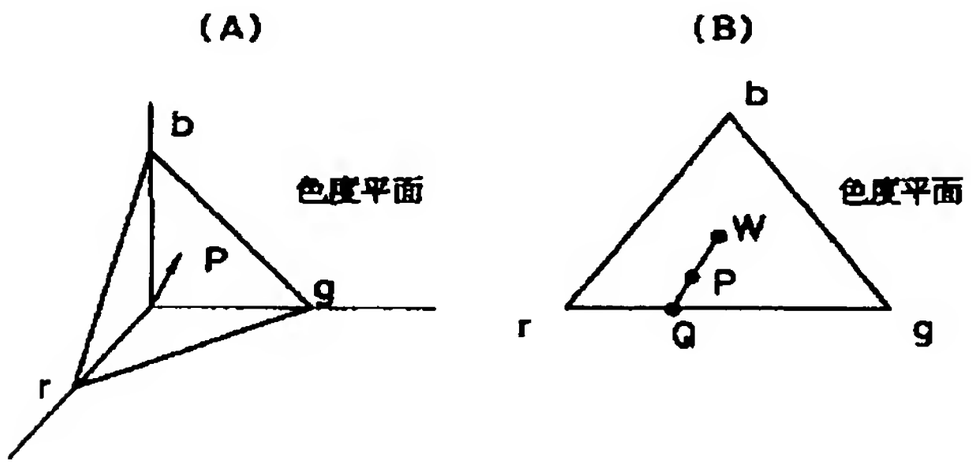
【図２】


START
S1
光沢センサーで採血試験管の位置決め
S2
カラーＣＣＤカメラでの採血試験管撮像情報キャプチャー
S3
ビデオ入力ボードへ送信
S4
ビットマップ形式の情報を変換
S5
ＲＧＢ濃淡情報に変換
S6
色度情報に変換
S7
採度情報に変換
S8
境界線認識
END

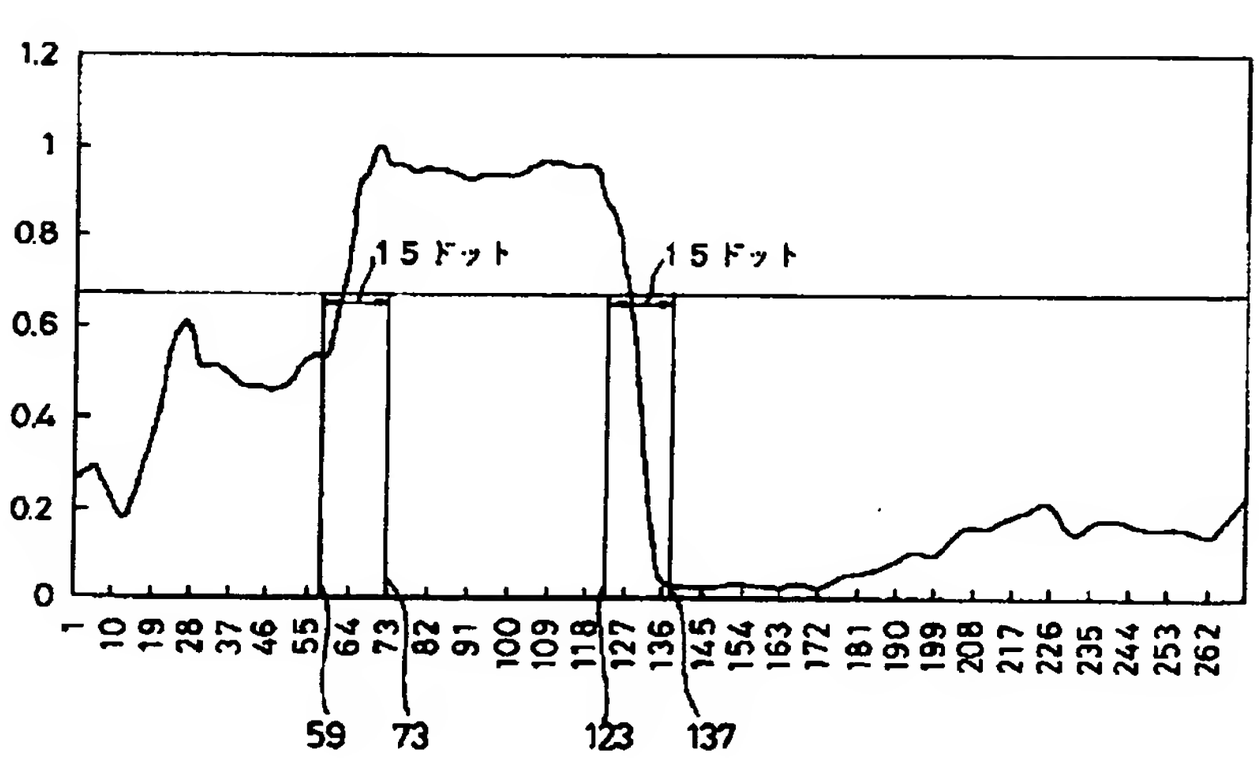
【図３】


11
11
認識領域

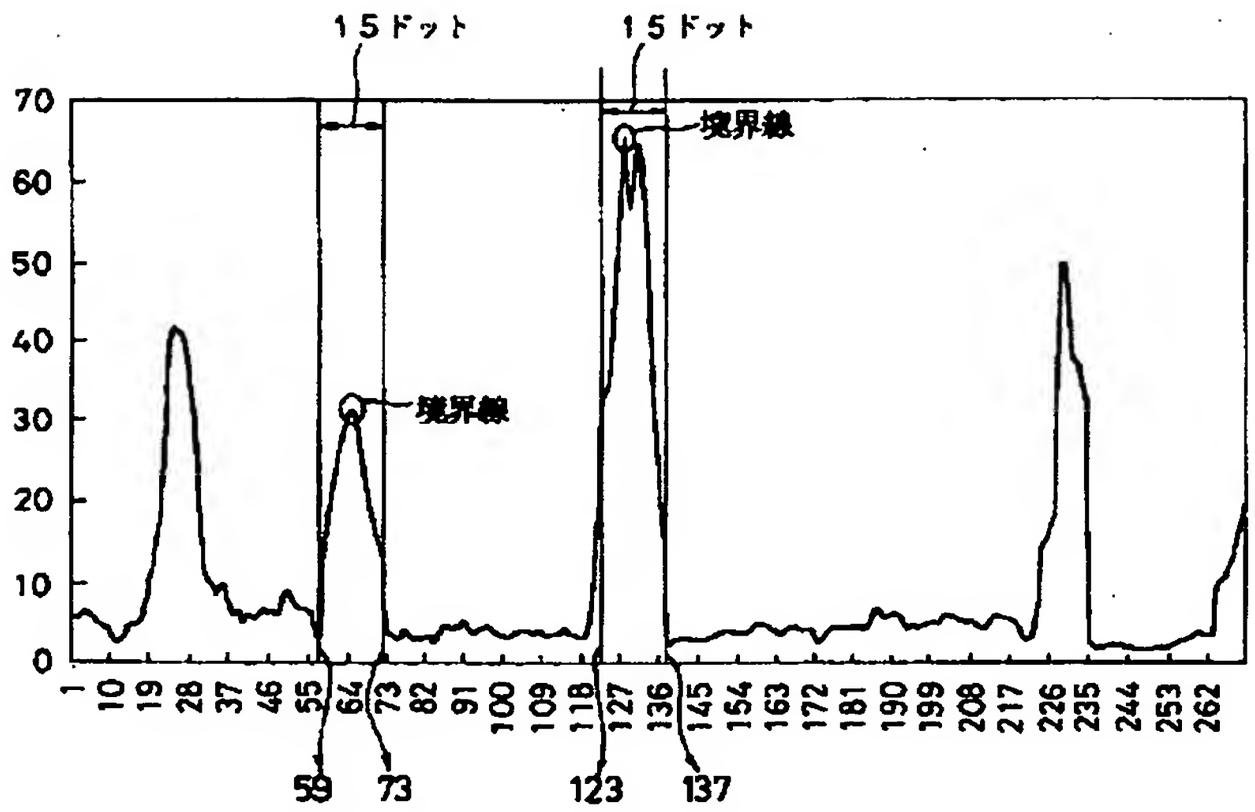
【図４】


(A)
b
色度平面
P
g
r
(B)
b
色度平面
W
P
r
Q
g

【図５】


1.2
1
0.8
0.6
0.4
0.2
0
15ドット
15ドット
1
10
19
28
37
46
55
64
73
82
91
100
109
118
127
136
145
154
163
172
181
190
199
208
217
226
235
244
253
262
59
73
123
137

【図６】




---

フロントページの続き

| (51)Int.Cl.[6] | 識別記号 | 庁内整理番号 | Ｆ Ｉ | | | 技術表示箇所 |
|---|---|---|---|---|---|---|
| Ｇ０６Ｔ　7/00 | | | Ｇ０６Ｆ | 15/62 | ３９５ | |
| | | | | 15/70 | ３１０ | |

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-133687
(43)Date of publication of application : 20.05.1997

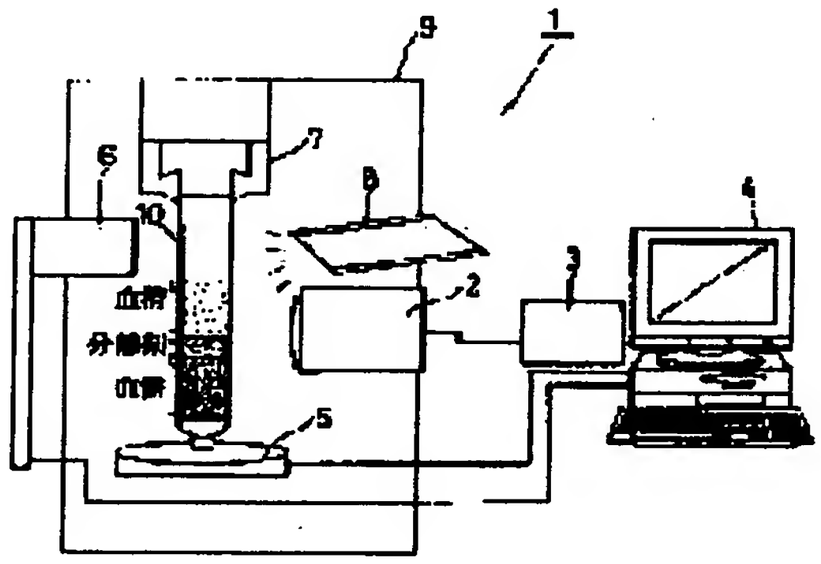
(51)Int.Cl. G01N 35/10
G01F 23/28
G01N 1/14
G01N 33/48
G01N 35/02
G06T 7/00

(21)Application number : 07-317079
(22)Date of filing : 13.11.1995

(71)Applicant : MEIJI DENKI KOGYO KK
(72)Inventor : TAKAHASHI TOSHITADA
ITO TOSHIAKI

## (54) INSTRUMENT FOR MEASURING QUANTITY OF SERUM IN BLOOD-COLLECTING TEST TUBE

(57)Abstract:
PROBLEM TO BE SOLVED: To inexpensively provide an instrument which can accurately and quickly measure the quantity of serum in a blood sample collected in a blood- collecting test tube and the position of the boundary between the blood clot or a separating agent and the serum and, in addition, to make it possible to directly dispense a blood sample from the test tube.
SOLUTION: A personal computer 4 obtains RGB gray level information, chromaticity information, and chroma information by processing the picture information of a blood-collecting test tube 10 taken with a color CCD camera 12 and finds the position of the boundary between the serum part and other parts of a blood sample collected in the tube 10 from the chroma information. In addition, the serum is made to be collected effectively from the test tube 10 by calculating the quantity of a collectable serum from the boundary information.




LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

---

## CLAIMS

---

[Claim(s)]
[Claim 1] A means to carry out color photography of the blood collecting test tube, and to acquire the color image pick-up information on this blood collecting test tube, A means to search for the red in each pixel of a color image pick-up, blue, and green shade information from said color image pick-up information, A means to remove lightness information from said shade information, and to search for chromaticity information, and a means to search for saturation information from said chromaticity information, The amount measuring device of blood serums in the blood collecting test tube characterized by consisting of said saturation information including a means to ask for the borderline location of a blood serum part and other parts among constituents of blood, and a means to calculate the amount of a blood serum extractable from said boundary information.
[Claim 2] The amount measuring device of blood serums in the blood collecting test tube according to claim 1 characterized by being constituted including a means to set a blood collecting test tube so that the location where the bar code label in which the specimen ID of said blood collecting test tube front face is shown is not stuck may turn to bearing of the exposure axis.
[Claim 3] A means to set said blood collecting test tube is the amount measuring device of blood serums in the blood collecting test tube according to claim 2 characterized by being constituted including a revolution means to rotate said blood collecting test tube, the glossiness sensor which detects said bar code label location, and the control means which controls said revolution means based on the detecting signal from said glossiness sensor.
[Claim 4] The amount measuring device [ in / among claims 1-3 characterized by being constituted including the means which makes a borderline location the location where the variation in each dot of the pixel of red, blue, and a **** component is calculated from the pixel order predetermined dot near / for which it asked with said saturation / the borderline location, and variation serves as max / the blood collecting test tube of any one publication ] of blood serums.
[Claim 5] The amount measuring device [ in / among claims 1-4 characterized by making a blood collecting test tube carry out abbreviation adhesion, placing the member of a white system behind the blood collecting test tube seen from said bearing of the exposure axis, and photoing a blood collecting test tube / the blood collecting test tube of any one publication ] of blood serums.

---

[Translation done.]

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About the amount measuring device of blood serums in a blood collecting test tube, in detail, this invention is faced extracting a blood serum required for automation study analysis with a distributive-pouring vessel etc. from the blood collecting test tube to which centrifugal separation was applied, and relates to the amount measuring device of blood serums which measures the amount of a blood serum part beforehand.
[0002]
[Description of the Prior Art] If centrifugal separation is applied to vacuum blood collecting tubing as a blood collecting test tube, it will separate into two-layer [ of the blood serum section and the clot section ] in this blood collecting tubing, and if a separating medium is put in, it will separate into three layers, a blood serum, a separating medium, and a clot.
[0003] Thus, from vacuum blood collecting tubing with which each component was separated, it pours distributively by sampling only a blood serum part required for a chemical analysis with an automatic machine. Although the approach of pouring distributively was taken in the former after moving only the blood serum section from vacuum blood collecting tubing to the sample container prepared independently when pouring distributively with an automatic machine, the direct blood serum part is extracted more often from this vacuum blood collecting tubing in recent years, using the vacuum blood collecting tubing itself used when collecting blood from a patient as a sample container. In this case, when a clot precipitates at the pars basilaris ossis occipitalis of vacuum blood collecting tubing and a separating medium is used, this separating medium comes to remain between a blood serum and a clot, and, thereby, a blood serum and a clot are separated in vacuum blood collecting tubing.
[0004]
[Problem(s) to be Solved by the Invention] However, when pouring distributively directly from vacuum blood collecting tubing as mentioned above, there is a trouble that it is difficult to carry out the specified quantity sampling only of the blood serum required for analysis. For example, since a distributive-pouring nozzle will reach to the depth of a clot or a separating medium and draws in to components other than a blood serum required for analysis when the amount of blood serums is not securable enough blood collecting tubing in the case of distributive pouring, there is a possibility of blocking said distributive-pouring nozzle.
[0005] For this reason, after moving only a blood serum part from vacuum blood collecting tubing to the sample container prepared independently, the approach before saying that it pours distributively is taken. If this is realized that what is necessary is just to be able to measure to accuracy before pouring distributively the capacity of the blood serum part in vacuum blood collecting tubing with which centrifugal separation was applied when pouring distributively directly from vacuum blood collecting tubing, in order to solve such a problem, the limited amount of blood serums will be assigned in order of the priority of required analysis and inspection, and the amount of blood collecting will become possible [ using few patients' blood serum effectively ].
[0006] From such a view, the approach of measuring the amount of blood serums in a blood

collecting test tube is proposed as follows by the former. For example, the sensor (interface detection sensor) which detects the boundary of each component is inserted into a blood collecting test tube, and the method of detecting the location of a clot or a separating medium is proposed. The technique which the technique which various classes of sensor in this case are proposed, for example, used the transceiver machine of a supersonic wave for JP,53-71897,A was indicated, and used the optical fiber for JP,53-116190,A is indicated.

[0007] Moreover, an electrode is inserted and the technique using a resistance difference or an impedance difference is also proposed. By the approach of detecting the location of a clot or a separating medium using the above sensor, the need for the desiccation after washing in order to insert a sensor into a blood serum, to fully wash a sensor for every one extraction in order that the blood serum of a before sample may prevent mixing in a next sample, especially when using it for analysis, and to prevent mixing after washing is also produced. Moreover, if a sensor is touched in the case of maintenance of equipment etc., there is possibility of the infection from a patient's blood and it is dangerous.

[0008] Moreover, by this conventional measuring method, while the magnitude of a facility is large-scale and great costs start plant-and-equipment investment, there is also a trouble that the interface location detection time concerning one blood collecting test tube starts for a long time.

[0009] Furthermore, the method of detecting the boundary of each component is proposed by the light which penetrates a test tube. For example, some methods of recognizing a boundary in quest of the property that make a test tube penetrate and permeability changes the light from one light source besides a test tube with wavelength of reception, the amount change of transmitted lights, or light by the light sensing portion etc. are proposed. (Refer to JP,2-40539,A, JP,2-38968,A, and JP,1-44464,A) .

[0010] By the way, although specimen ID signalling which prepared the bar code label in which Specimen ID is shown in the front face of vacuum blood collecting tubing is adopted and prevention of a specimen handling mistake, rationalization of measurement, etc. are attained by this In order to apply the above-mentioned approach to the amount measurement of blood serums with vacuum blood collecting tubing It is necessary to remove the bar code label in which the specimen ID stuck on the front face of vacuum blood collecting tubing is shown, or to limit only to transparency detection in the location where a bar code label is not stuck, and is not suitable as the approach of the amount measurement of blood serums from vacuum blood collecting tubing.

[0011] Then, even if you are in the condition that the bar code label in which Specimen ID is shown was stuck on the front face of for example, a blood collecting test tube, without making this invention in view of the above, and inserting a sensor into a blood serum, the equipment which measures correctly and promptly the boundary location of the amount of blood serums, a clot or a separating medium, and a blood serum is offered cheaply, and let it be a technical problem to make it possible to annotate by direct from a blood collecting test tube.

[0012]

[Means for Solving the Problem] For this reason, a means for invention concerning claim 1 to carry out color photography of the blood collecting test tube, and to acquire the color image pick-up information on this blood collecting test tube, A means to search for the red in each pixel of a color image pick-up, blue, and green shade information from said color image pick-up information, A means to remove lightness information from said shade information, and to search for chromaticity information, and a means to search for saturation information from said chromaticity information, It constituted from said saturation information including a means to ask for the borderline location of a blood serum part and other parts among constituents of blood, and a means to calculate the amount of a blood serum extractable from said boundary information.

[0013] Invention according to claim 2 was constituted including a means to set a blood collecting test tube so that the location where the bar code label in which the specimen ID of said blood collecting test tube front face is shown is not stuck might turn to bearing of the exposure axis.

[0014] A means by which invention according to claim 3 set said blood collecting test tube was

constituted including a revolution means to rotate said blood collecting test tube, the glossiness sensor which detects said bar code label location, and the control means which controls said revolution means based on the detecting signal from said glossiness sensor.
[0015] Invention according to claim 4 calculated the variation in each dot of the pixel of red, blue, and a **** component from the pixel order predetermined dot near [ for which it asked with said saturation ] the borderline location, and variation constituted it including the means which makes the location used as max a borderline location.
[0016] Behind the blood collecting test tube seen from said bearing of the exposure axis, a blood collecting test tube is made to carry out abbreviation adhesion, and invention according to claim 5 places the member of a white system, and photoed the blood collecting test tube.
[0017]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained in full detail based on a drawing. First, the principle of this invention is explained. When blood is separated for every component by the centrifuge method, each component presents an original color, respectively. By recognizing a difference of this color from the red who incorporated from the color picture, green, and the shade information on blue (RGB), the boundary of a blood serum part and other parts is recognized among constituents of blood, and the amount of blood serums is calculated after this.
[0018] this invention persons analyzed the color picture of the blood collecting test tube after centrifugal separation. Consequently, the chromaticity information (mixing ratio of RGB each component to the average of RGB) which removed lightness information from the shade information on RGB could be searched for, and it has checked that the saturation value calculated from this chromaticity information showed a value high in a blood serum part.
[0019] While this looks a blood serum part is highly transparent and vivid as an image, a clot is the solid of a blackish color and image top vividness depends it on a low thing. Moreover, it is because a separating medium also presents opalescence and vividness looks low clearly compared with a blood serum part. Not only when it is the yellow which blood with the normal color of a blood serum shows, but in the blood serum near red etc., it will be applied, and these things can calculate the field of a blood serum part in almost all blood collecting tubing by recognizing the field where saturation is high.
[0020] Drawing showing the concrete configuration of 1 operation gestalt of the amount measuring device of blood serums of this invention based on the above principles in drawing 1 and drawing 2 are the flow charts explaining the content of control of this equipment. In drawing 1 first, the amount measuring device 1 of blood serums of a blood collecting test tube Color CCD camera (only henceforth a camera) 2, and the video input board 3, A personal computer 4 and the motor 5 for a test tube revolution (only henceforth a motor), the glossiness sensor (for bar code label location detection) 6, the test tube chuck 7, and the lighting 8 for image photography -- since -- it is constituted, and gets down and a camera 2, a motor 5, the glossiness sensor 6, the test tube chuck 7, and lighting 8 are arranged in the measurement black box 9, respectively.
[0021] Here, said camera 2 carries out color photography of the blood collecting test tube 10, and constitutes a means to acquire the color image pick-up information on this blood collecting test tube 10. Moreover, red [ in / in said personal computer 4 / each pixel of the color image pick-up from said color image pick-up information ], Blue, a means to search for shade information [ being green (RGB) ], a means to remove lightness information from said RGB shade information, and to search for chromaticity information, A means to search for saturation information from said chromaticity information, a means to ask for the borderline location of a blood serum part and other parts among constituents of blood from said saturation information, The variation in each dot of the pixel of RGB each component is calculated from the pixel order predetermined dot near [ for which it asked with a means to calculate the amount of a blood serum extractable from said boundary information, and said saturation ] the borderline location. Variation has equipped the function by software as each means of the means which makes the location used as max a borderline location.
[0022] Moreover, a means set the blood-collecting test tube 10 constitutes, and a personal

computer 4 has equipped by software the function as a control means which controls said motor 5 as a revolution means based on the detecting signal from the glossiness sensor 6 so that the location where the bar code label in which said motor 5, the glossiness sensor 6, and a personal computer 4 rotate the blood-collecting test tube 10, and the specimen ID of this blood-collecting test tube 10 front face is shown is not stuck may turn to bearing of the exposure axis.

[0023] Amount measurement processing of the blood serum part using this amount measuring device 1 of blood serums is performed as follows. That is, the blood collecting test tube 10 is placed in front of a camera 2, and it is made for the location where the bar code label which is made to rotate the blood collecting test tube 10, and shows Specimen ID to the transverse plane of a camera 2 by the motor 5 is not stuck to come.
[0024] In this case, although the location where the bar code label is not stuck on reverse by a bar code label's sticking and detecting a location is got to know, this is an approach generally used and said glossiness sensor 6 can perform it easily. When the blood collecting test tube 10 of the location where the bar code label is not stuck in front of the camera 2 is reflected, the color image of the blood collecting test tube 10 is incorporated on a video input board.
[0025] The image of the video input board 3 is captured in a personal computer 4 in a bit map format, 8 dot each each [ of right and left ] pixel is extracted from the center line of the perpendicular direction of a blood collecting test tube image to recognition, and it changes into the shade information on RGB in each pixel. Although 8 dots of right and left were used for the number of pixels to extract with this operation gestalt, it is what was adopted as an example of recognition count, and this invention itself is not limited to 8 dots of right and left. From the shade information on this RGB, recognition count of the boundary of the oil-level location of a blood serum part and a clot or a separating medium, and a blood serum part is carried out.
[0026] Next, with reference to the flow chart of drawing 2 , the detail of amount measurement processing of the above-mentioned blood serum part is explained based on the content of control of a personal computer 4.
[0027] It is step 1 (it is written as S1 by a diagram.) first. the following -- being the same -- it sets and a blood collecting test tube is positioned using the glossiness sensor 6. That is, a control side is ordered the location which does not have a bar code label using the glossiness sensor 6 so that it can incorporate without the image of the recognition field shown in drawing 3 overlapping the bar code label 11.
[0028] In step 2, the image pick-up information on the blood collecting test tube 10 is acquired with a camera 2. That is, if a personal computer 4 receives the control signal of the glossiness sensor 6, it will capture blood collecting test tube image pick-up information with a camera 2.
[0029] In step 3, blood collecting test tube information is transmitted to the video input board 3 as an NTSC video input signal from a camera 2.
[0030] At step 4, the information from the video input board 3 is changed into a well-known bit map format.
[0031] At step 5, it changes into the RGB shade information in each pixel from bit map format information.
[0032] At step 6, it is made the chromaticity information (r, g, b) which removed lightness information from RGB shade information.
Namely, r=R/(R+G+B)
g=G/(R+G+B)
b=G/(R+G+B)
r+g+b=1 It considers as a chromaticity flat surface.
[0033] Saturation information is searched for at step 7. That is, as shown in drawing 4 (A), chromaticity information (r, g, b) serves as a set of the point on the same flat surface (r+g+b=1 chromaticity flat surface), and asks for saturation from the point on a flat surface as shown in this drawing. Saturation is expressed with the ratio of WP/WQ in drawing 4 (B) (reference image-processing applied-technology Kogyo Chosakai Publishing). In this case, the point W of drawing 4 (B) expresses an achromatic color at the center of gravity of an equilateral triangle. Points P are a point on extension of Segment WP, and an intersection of point r+g+b=1 (r>=0, g>=0, b>=0) on

a flat surface.
[0034] A borderline is recognized at step 8. That is, since a blood serum part has the value of saturation higher than other parts, it recognizes the part to be a blood serum. A detailed description of this asks for the moving average from the incorporation starting position of saturation information to termination. If this is expressed with a graph, it will become like drawing 5 . A blood serum part determines the default value which can surely be extracted, and recognizes an upper part as a blood serum part from the level determined with the default value. The maximum of |Rn+1−Rn |+|Gn+1−Gn |+|Bn+1−Bn | (refer to the graph of drawing 6 ) of the part is detected by making 15 dots into a recognition region around the pixel of the ends recognized as a blood serum part as an interface location of a blood serum front face or a blood serum, and a separating medium.
[0035] The capacity of a blood serum extractable for every classification of a blood collecting test tube is calculable by giving the classification of the photoed blood collecting test tube to the blood serum boundary information searched for according to the above operation.
[0036] In addition, when the rear-spring-supporter bar code label 11 is stuck more than the semicircle of the blood collecting test tube 10 by putting the lighting 8 to be used in the recognition of the amount of blood serums based on this saturation information from the transverse plane of the blood collecting test tube 10 and it sees from the transverse plane of a camera 2, if there is about 6mm or more of clearances where the bar code label 11 is not stuck, recognition of the amount of blood serums is possible.
[0037] Moreover, it can recognize with this configuration which recognizes a blood serum field based on saturation information, without being influenced of the alphabetic character which is photography by the reflected light and was printed by the bar code label, and a notation.
[0038] Furthermore, it is desirable to perform range correction processing for deducing the magnitude of a measurement object from a video image actually in addition to each above-mentioned processing. This range correction photos the points (for example, LED etc.) that distance became settled with the test tube image, always amends distance, and guarantees the accuracy of measurement.
[0039] With the blood collecting test tube 10 which extracted direct blood from the patient by using the equipment which recognizes the boundary location of the blood serum capacity in the blood collecting test tube 10 and a clot or a separating medium, and a blood serum from a color picture with a camera 2 according to this configuration With the condition that the bar code label was stuck, since the amount of blood serums can be obtained before distributive pouring to accuracy, among the extracted blood, according to the extractable amount of blood serums, it becomes possible to assign a blood serum from analysis and inspection with high priority more, and a deployment of a precious blood serum is attained.
[0040] Moreover, it is not necessary to insert a sensor into the blood collecting test tube 10, and, therefore, sensor washing etc. can manufacture an unnecessary safe distributive-pouring machine easily by telling a distributive-pouring machine about the boundary location of a blood serum oil-level location and a clot or a separating medium, and a blood serum.
[0041] Furthermore, in this measuring device, the magnitude of a facility is small, there are few costs concerning plant-and-equipment investment, and they end, and the interface location detection time concerning one blood collecting test tube also has the advantage of being short.
[0042] In addition, in the above-mentioned configuration, the classification of the blood collecting test tube to be used can also be recognized from the incorporated color picture. Moreover, if the paper of the member of the white system which carried out abbreviation adhesion, for example, white, and light gray, or the body of plastics is placed behind the blood collecting test tube 10 seen from the camera 2 at the blood collecting test tube 10 The lightness of the blood serum image in the part on which the bar code label was stuck by the blood collecting test tube image, and the part on which a bar code label is not stuck, saturation, and the image that does not almost have the difference of a hue can be obtained, and it can consider as photography of blood collecting tubing which lessens effect of a bar code label.
[0043]
[Effect of the Invention] Since the amount of blood serums can be obtained before distributive

pouring to accuracy according to invention concerning claim 1 as explained above, While becoming possible to assign a blood serum from analysis and inspection with high priority more and attaining a deployment of a precious blood serum according to the extractable amount of blood serums among the extracted blood By telling a distributive-pouring machine about the boundary location of a blood serum oil-level location and a clot or a separating medium, and a blood serum It is not necessary to insert a sensor into a blood collecting test tube, and therefore sensor washing etc. can manufacture an unnecessary safe distributive-pouring machine easily, moreover, the magnitude of a facility is small, there are few costs concerning plant-and-equipment investment, and they end, and the interface location detection time concerning one blood collecting test tube also has the advantage of being short.

[0044] According to invention concerning claim 2, the amount of blood serums can be obtained from a patient before distributive pouring to accuracy with the condition which shows Specimen ID with the blood collecting test tube which extracted direct blood that the bar code label was stuck.

[0045] According to invention concerning claim 3, a glossiness sensor can detect easily the location where the bar code label is not stuck, and the location of a blood collecting test tube can be controlled proper.

[0046] According to invention concerning claim 4, the borderline location of a blood serum part and other parts is more discriminable from saturation information to accuracy among constituents of blood.

[0047] According to invention concerning claim 5, the lightness of the blood serum image in the part on which the bar code label was stuck by the blood collecting test tube image, and the part on which a bar code label is not stuck, saturation, and the image that does not almost have the difference of a hue can be obtained, and it can consider as photography of blood collecting tubing which lessens effect of a bar code label.

---

[Translation done.]

## TECHNICAL FIELD

[Field of the Invention] About the amount measuring device of blood serums in a blood collecting test tube, in detail, this invention is faced extracting a blood serum required for automation study analysis with a distributive-pouring vessel etc. from the blood collecting test tube to which centrifugal separation was applied, and relates to the amount measuring device of blood serums which measures the amount of a blood serum part beforehand.

## PRIOR ART

[Description of the Prior Art] If centrifugal separation is applied to vacuum blood collecting tubing as a blood collecting test tube, it will separate into two-layer [ of the blood serum section and the clot section ] in this blood collecting tubing, and if a separating medium is put in, it will separate into three layers, a blood serum, a separating medium, and a clot.

[0003] Thus, from vacuum blood collecting tubing with which each component was separated, it pours distributively by sampling only a blood serum part required for a chemical analysis with an automatic machine. Although the approach of pouring distributively was taken in the former after moving only the blood serum section from vacuum blood collecting tubing to the sample container prepared independently when pouring distributively with an automatic machine, the direct blood serum part is extracted more often from this vacuum blood collecting tubing in recent years, using the vacuum blood collecting tubing itself used when collecting blood from a patient as a sample container. In this case, when a clot precipitates at the pars basilaris ossis occipitalis of vacuum blood collecting tubing and a separating medium is used, this separating medium comes to remain between a blood serum and a clot, and, thereby, a blood serum and a clot are separated in vacuum blood collecting tubing.

[Translation done.]

* NOTICES *



---

## EFFECT OF THE INVENTION

---

[Effect of the Invention] Since the amount of blood serums can be obtained before distributive pouring to accuracy according to invention concerning claim 1 as explained above, While becoming possible to assign a blood serum from analysis and inspection with high priority more and attaining a deployment of a precious blood serum according to the extractable amount of blood serums among the extracted blood By telling a distributive-pouring machine about the boundary location of a blood serum oil-level location and a clot or a separating medium, and a blood serum It is not necessary to insert a sensor into a blood collecting test tube, and therefore sensor washing etc. can manufacture an unnecessary safe distributive-pouring machine easily, moreover, the magnitude of a facility is small, there are few costs concerning plant-and-equipment investment, and they end, and the interface location detection time concerning one blood collecting test tube also has the advantage of being short.
[0044] According to invention concerning claim 2, the amount of blood serums can be obtained from a patient before distributive pouring to accuracy with the condition which shows Specimen ID with the blood collecting test tube which extracted direct blood that the bar code label was stuck.
[0045] According to invention concerning claim 3, a glossiness sensor can detect easily the location where the bar code label is not stuck, and the location of a blood collecting test tube can be controlled proper.
[0046] According to invention concerning claim 4, the borderline location of a blood serum part and other parts is more discriminable from saturation information to accuracy among constituents of blood.
[0047] According to invention concerning claim 5, the lightness of the blood serum image in the part on which the bar code label was stuck by the blood collecting test tube image, and the part on which a bar code label is not stuck, saturation, and the image that does not almost have the difference of a hue can be obtained, and it can consider as photography of blood collecting tubing which lessens effect of a bar code label.

---

[Translation done.]

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when pouring distributively directly from vacuum blood collecting tubing as mentioned above, there is a trouble that it is difficult to carry out the specified quantity sampling only of the blood serum required for analysis. For example, since a distributive-pouring nozzle will reach to the depth of a clot or a separating medium and draws in to components other than a blood serum required for analysis when the amount of blood serums is not securable enough blood collecting tubing in the case of distributive pouring, there is a possibility of blocking said distributive-pouring nozzle.

[0005] For this reason, after moving only a blood serum part from vacuum blood collecting tubing to the sample container prepared independently, the approach before saying that it pours distributively is taken. If this is realized that what is necessary is just to be able to measure to accuracy before pouring distributively the capacity of the blood serum part in vacuum blood collecting tubing with which centrifugal separation was applied when pouring distributively directly from vacuum blood collecting tubing, in order to solve such a problem, the limited amount of blood serums will be assigned in order of the priority of required analysis and inspection, and the amount of blood collecting will become possible [ using few patients' blood serum effectively ].

[0006] From such a view, the approach of measuring the amount of blood serums in a blood collecting test tube is proposed as follows by the former. For example, the sensor (interface detection sensor) which detects the boundary of each component is inserted into a blood collecting test tube, and the method of detecting the location of a clot or a separating medium is proposed. The technique which the technique which various classes of sensor in this case are proposed, for example, used the transceiver machine of a supersonic wave for JP,53-71897,A was indicated, and used the optical fiber for JP,53-116190,A is indicated.

[0007] Moreover, an electrode is inserted and the technique using a resistance difference or an impedance difference is also proposed. By the approach of detecting the location of a clot or a separating medium using the above sensor, the need for the desiccation after washing in order to insert a sensor into a blood serum, to fully wash a sensor for every one extraction in order that the blood serum of a before sample may prevent mixing in a next sample, especially when using it for analysis, and to prevent mixing after washing is also produced. Moreover, if a sensor is touched in the case of maintenance of equipment etc., there is possibility of the infection from a patient's blood and it is dangerous.

[0008] Moreover, by this conventional measuring method, while the magnitude of a facility is large-scale and great costs start plant-and-equipment investment, there is also a trouble that the interface location detection time concerning one blood collecting test tube starts for a long time.

[0009] Furthermore, the method of detecting the boundary of each component is proposed by the light which penetrates a test tube. For example, some methods of recognizing a boundary in quest of the property that make a test tube penetrate and permeability changes the light from one light source besides a test tube with wavelength of reception, the amount change of transmitted lights, or light by the light sensing portion etc. are proposed. (Refer to JP,2-40539,A, JP,2-38968,A, and JP,1-44464,A) .

[0010] By the way, although specimen ID signalling which prepared the bar code label in which Specimen ID is shown in the front face of vacuum blood collecting tubing is adopted and prevention of a specimen handling mistake, rationalization of measurement, etc. are attained by this In order to apply the above-mentioned approach to the amount measurement of blood serums with vacuum blood collecting tubing It is necessary to remove the bar code label in which the specimen ID stuck on the front face of vacuum blood collecting tubing is shown, or to limit only to transparency detection in the location where a bar code label is not stuck, and is not suitable as the approach of the amount measurement of blood serums from vacuum blood collecting tubing.

[0011] Then, even if you are in the condition that the bar code label in which Specimen ID is shown was stuck on the front face of for example, a blood collecting test tube, without making this invention in view of the above, and inserting a sensor into a blood serum, the equipment which measures correctly and promptly the boundary location of the amount of blood serums, a clot or a separating medium, and a blood serum is offered cheaply, and let it be a technical problem to make it possible to annotate by direct from a blood collecting test tube.

---

[Translation done.]

---

## MEANS

---

[Means for Solving the Problem] For this reason, a means for invention concerning claim 1 to carry out color photography of the blood collecting test tube, and to acquire the color image pick-up information on this blood collecting test tube, A means to search for the red in each pixel of a color image pick-up, blue, and green shade information from said color image pick-up information, A means to remove lightness information from said shade information, and to search for chromaticity information, and a means to search for saturation information from said chromaticity information, It constituted from said saturation information including a means to ask for the borderline location of a blood serum part and other parts among constituents of blood, and a means to calculate the amount of a blood serum extractable from said boundary information.
[0013] Invention according to claim 2 was constituted including a means to set a blood collecting test tube so that the location where the bar code label in which the specimen ID of said blood collecting test tube front face is shown is not stuck might turn to bearing of the exposure axis.
[0014] A means by which invention according to claim 3 set said blood collecting test tube was constituted including a revolution means to rotate said blood collecting test tube, the glossiness sensor which detects said bar code label location, and the control means which controls said revolution means based on the detecting signal from said glossiness sensor.
[0015] Invention according to claim 4 calculated the variation in each dot of the pixel of red, blue, and a **** component from the pixel order predetermined dot near [ for which it asked with said saturation ] the borderline location, and variation constituted it including the means which makes the location used as max a borderline location.
[0016] Behind the blood collecting test tube seen from said bearing of the exposure axis, a blood collecting test tube is made to carry out abbreviation adhesion, and invention according to claim 5 places the member of a white system, and photoed the blood collecting test tube.
[0017]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained in full detail based on a drawing. First, the principle of this invention is explained. When blood is separated for every component by the centrifuge method, each component presents an original color, respectively. By recognizing a difference of this color from the red who incorporated from the color picture, green, and the shade information on blue (RGB), the boundary of a blood serum part and other parts is recognized among constituents of blood, and the amount of blood serums is calculated after this.
[0018] this invention persons analyzed the color picture of the blood collecting test tube after centrifugal separation. Consequently, the chromaticity information (mixing ratio of RGB each component to the average of RGB) which removed lightness information from the shade information on RGB could be searched for, and it has checked that the saturation value calculated from this chromaticity information showed a value high in a blood serum part.
[0019] While this looks a blood serum part is highly transparent and vivid as an image, a clot is the solid of a blackish color and image top vividness depends it on a low thing. Moreover, it is because a separating medium also presents opalescence and vividness looks low clearly compared with a blood serum part. Not only when it is the yellow which blood with the normal

color of a blood serum shows, but in the blood serum near red etc., it will be applied, and these things can calculate the field of a blood serum part in almost all blood collecting tubing by recognizing the field where saturation is high.
[0020] Drawing showing the concrete configuration of 1 operation gestalt of the amount measuring device of blood serums of this invention based on the above principles in drawing 1 and drawing 2 are the flow charts explaining the content of control of this equipment. In drawing 1 first, the amount measuring device 1 of blood serums of a blood collecting test tube Color CCD camera (only henceforth a camera) 2, and the video input board 3, A personal computer 4 and the motor 5 for a test tube revolution (only henceforth a motor), the glossiness sensor (for bar code label location detection) 6, the test tube chuck 7, and the lighting 8 for image photography -- since -- it is constituted, and gets down and a camera 2, a motor 5, the glossiness sensor 6, the test tube chuck 7, and lighting 8 are arranged in the measurement black box 9, respectively.
[0021] Here, said camera 2 carries out color photography of the blood collecting test tube 10, and constitutes a means to acquire the color image pick-up information on this blood collecting test tube 10. Moreover, red [ in / in said personal computer 4 / each pixel of the color image pick-up from said color image pick-up information ], Blue, a means to search for shade information [ being green (RGB) ], a means to remove lightness information from said RGB shade information, and to search for chromaticity information, A means to search for saturation information from said chromaticity information, a means to ask for the borderline location of a blood serum part and other parts among constituents of blood from said saturation information, The variation in each dot of the pixel of RGB each component is calculated from the pixel order predetermined dot near [ for which it asked with a means to calculate the amount of a blood serum extractable from said boundary information, and said saturation ] the borderline location. Variation has equipped the function by software as each means of the means which makes the location used as max a borderline location.
[0022] Moreover, a means set the blood-collecting test tube 10 constitutes, and a personal computer 4 has equipped by software the function as a control means which controls said motor 5 as a revolution means based on the detecting signal from the glossiness sensor 6 so that the location where the bar code label in which said motor 5, the glossiness sensor 6, and a personal computer 4 rotate the blood-collecting test tube 10, and the specimen ID of this blood-collecting test tube 10 front face is shown is not stuck may turn to bearing of the exposure axis.

[0023] Amount measurement processing of the blood serum part using this amount measuring device 1 of blood serums is performed as follows. That is, the blood collecting test tube 10 is placed in front of a camera 2, and it is made for the location where the bar code label which is made to rotate the blood collecting test tube 10, and shows Specimen ID to the transverse plane of a camera 2 by the motor 5 is not stuck to come.
[0024] In this case, although the location where the bar code label is not stuck on reverse by a bar code label's sticking and detecting a location is got to know, this is an approach generally used and said glossiness sensor 6 can perform it easily. When the blood collecting test tube 10 of the location where the bar code label is not stuck in front of the camera 2 is reflected, the color image of the blood collecting test tube 10 is incorporated on a video input board.
[0025] The image of the video input board 3 is captured in a personal computer 4 in a bit map format, 8 dot each each [ of right and left ] pixel is extracted from the center line of the perpendicular direction of a blood collecting test tube image to recognition, and it changes into the shade information on RGB in each pixel. Although 8 dots of right and left were used for the number of pixels to extract with this operation gestalt, it is what was adopted as an example of recognition count, and this invention itself is not limited to 8 dots of right and left. From the shade information on this RGB, recognition count of the boundary of the oil-level location of a blood serum part and a clot or a separating medium, and a blood serum part is carried out.
[0026] Next, with reference to the flow chart of drawing 2 , the detail of amount measurement processing of the above-mentioned blood serum part is explained based on the content of control of a personal computer 4.

[0027] It is step 1 (it is written as S1 by a diagram.) first. the following -- being the same -- it sets and a blood collecting test tube is positioned using the glossiness sensor 6. That is, a control side is ordered the location which does not have a bar code label using the glossiness sensor 6 so that it can incorporate without the image of the recognition field shown in drawing 3 overlapping the bar code label 11.
[0028] In step 2, the image pick-up information on the blood collecting test tube 10 is acquired with a camera 2. That is, if a personal computer 4 receives the control signal of the glossiness sensor 6, it will capture blood collecting test tube image pick-up information with a camera 2.
[0029] In step 3, blood collecting test tube information is transmitted to the video input board 3 as an NTSC video input signal from a camera 2.
[0030] At step 4, the information from the video input board 3 is changed into a well-known bit map format.
[0031] At step 5, it changes into the RGB shade information in each pixel from bit map format information.
[0032] At step 6, it is made the chromaticity information (r, g, b) which removed lightness information from RGB shade information.
Namely, r=R/(R+G+B)
g=G/(R+G+B)
b=G/(R+G+B)
r+g+b=1 It considers as a chromaticity flat surface.
[0033] Saturation information is searched for at step 7. That is, as shown in drawing 4 (A), chromaticity information (r, g, b) serves as a set of the point on the same flat surface (r+g+b=1 chromaticity flat surface), and asks for saturation from the point on a flat surface as shown in this drawing. Saturation is expressed with the ratio of WP/WQ in drawing 4 (B) (reference image-processing applied-technology Kogyo Chosakai Publishing). In this case, the point W of drawing 4 (B) expresses an achromatic color at the center of gravity of an equilateral triangle. Points P are a point on extension of Segment WP, and an intersection of point r+g+b=1 (r>=0, g>=0, b>=0) on a flat surface.
[0034] A borderline is recognized at step 8. That is, since a blood serum part has the value of saturation higher than other parts, it recognizes the part to be a blood serum. A detailed description of this asks for the moving average from the incorporation starting position of saturation information to termination. If this is expressed with a graph, it will become like drawing 5 . A blood serum part determines the default value which can surely be extracted, and recognizes an upper part as a blood serum part from the level determined with the default value. The maximum of |Rn+1-Rn |+|Gn+1-Gn |+|Bn+1-Bn | (refer to the graph of drawing 6 ) of the part is detected by making 15 dots into a recognition region around the pixel of the ends recognized as a blood serum part as an interface location of a blood serum front face or a blood serum, and a separating medium.
[0035] The capacity of a blood serum extractable for every classification of a blood collecting test tube is calculable by giving the classification of the photoed blood collecting test tube to the blood serum boundary information searched for according to the above operation.
[0036] In addition, when the rear-spring-supporter bar code label 11 is stuck more than the semicircle of the blood collecting test tube 10 by putting the lighting 8 to be used in the recognition of the amount of blood serums based on this saturation information from the transverse plane of the blood collecting test tube 10 and it sees from the transverse plane of a camera 2, if there is about 6mm or more of clearances where the bar code label 11 is not stuck, recognition of the amount of blood serums is possible.
[0037] Moreover, it can recognize with this configuration which recognizes a blood serum field based on saturation information, without being influenced of the alphabetic character which is photography by the reflected light and was printed by the bar code label, and a notation.
[0038] Furthermore, it is desirable to perform range correction processing for deducing the magnitude of a measurement object from a video image actually in addition to each above-mentioned processing. This range correction photos the points (for example, LED etc.) that distance became settled with the test tube image, always amends distance, and guarantees the

accuracy of measurement.
[0039] With the blood collecting test tube 10 which extracted direct blood from the patient by using the equipment which recognizes the boundary location of the blood serum capacity in the blood collecting test tube 10 and a clot or a separating medium, and a blood serum from a color picture with a camera 2 according to this configuration With the condition that the bar code label was stuck, since the amount of blood serums can be obtained before distributive pouring to accuracy, among the extracted blood, according to the extractable amount of blood serums, it becomes possible to assign a blood serum from analysis and inspection with high priority more, and a deployment of a precious blood serum is attained.
[0040] Moreover, it is not necessary to insert a sensor into the blood collecting test tube 10, and, therefore, sensor washing etc. can manufacture an unnecessary safe distributive-pouring machine easily by telling a distributive-pouring machine about the boundary location of a blood serum oil-level location and a clot or a separating medium, and a blood serum.
[0041] Furthermore, in this measuring device, the magnitude of a facility is small, there are few costs concerning plant-and-equipment investment, and they end, and the interface location detection time concerning one blood collecting test tube also has the advantage of being short.
[0042] In addition, in the above-mentioned configuration, the classification of the blood collecting test tube to be used can also be recognized from the incorporated color picture. Moreover, if the paper of the member of the white system which carried out abbreviation adhesion, for example, white, and light gray, or the body of plastics is placed behind the blood collecting test tube 10 seen from the camera 2 at the blood collecting test tube 10 The lightness of the blood serum image in the part on which the bar code label was stuck by the blood collecting test tube image, and the part on which a bar code label is not stuck, saturation, and the image that does not almost have the difference of a hue can be obtained, and it can consider as photography of blood collecting tubing which lessens effect of a bar code label.

---

[Translation done.]

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the concrete configuration of 1 operation gestalt of the amount measuring device of blood serums of this invention
[Drawing 2] The flow chart explaining the content of control of equipment same as the above
[Drawing 3] Drawing showing the relation between the image of a recognition field, and a bar code label
[Drawing 4] For (A), (B) is drawing showing chromaticity information, and drawing showing saturation.
[Drawing 5] The graph showing the moving average from the incorporation starting position of saturation information to termination
[Drawing 6] | The graph showing Rn+1−Rn |+|Gn+1−Gn |+|Bn+1−Bn |
[Description of Notations]
1 The Amount Measuring Device of Blood Serums
2 Color CCD Camera
3 Video Input Board
4 Personal Computer
5 Motor for Test Tube Revolution
6 Glossiness Sensor
10 Blood Collecting Test Tube
11 Bar Code Label

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

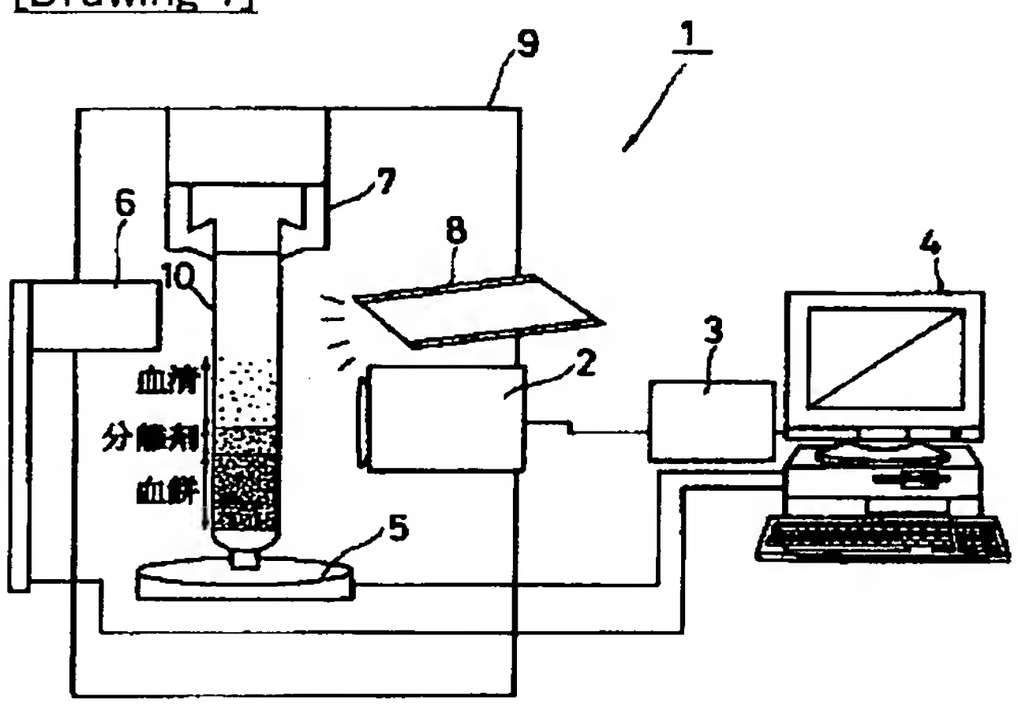
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

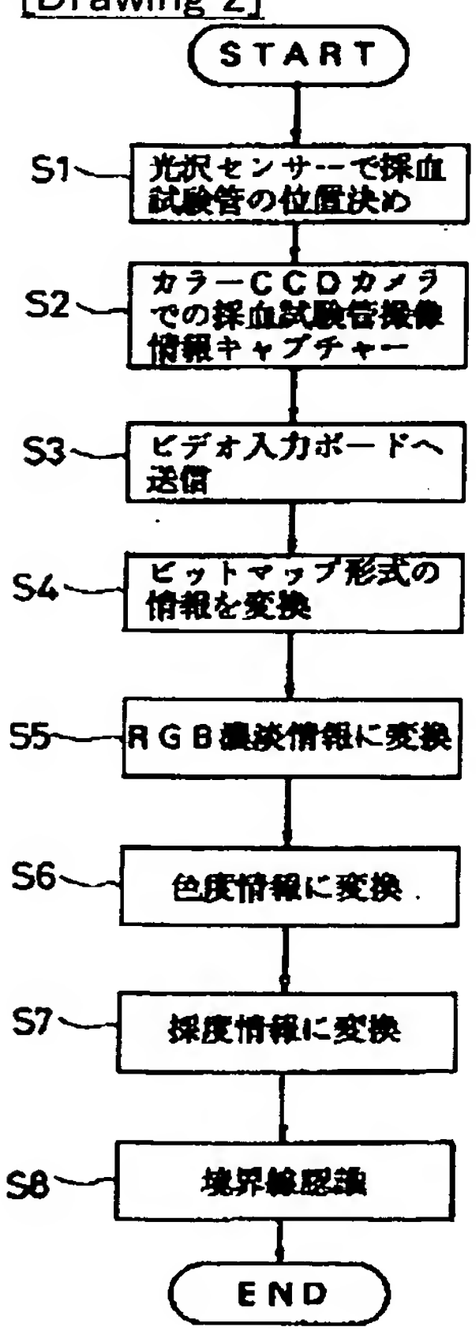
## DRAWINGS

---

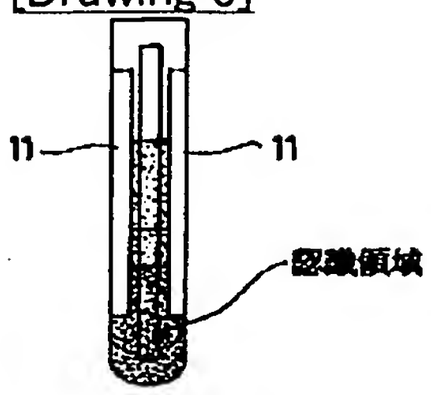
[Drawing 1]



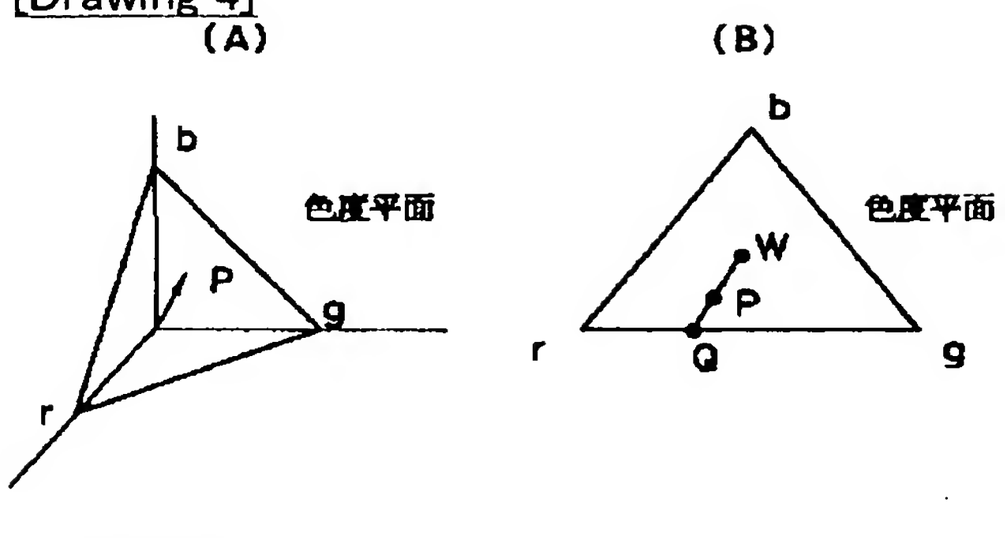

[Drawing 2]



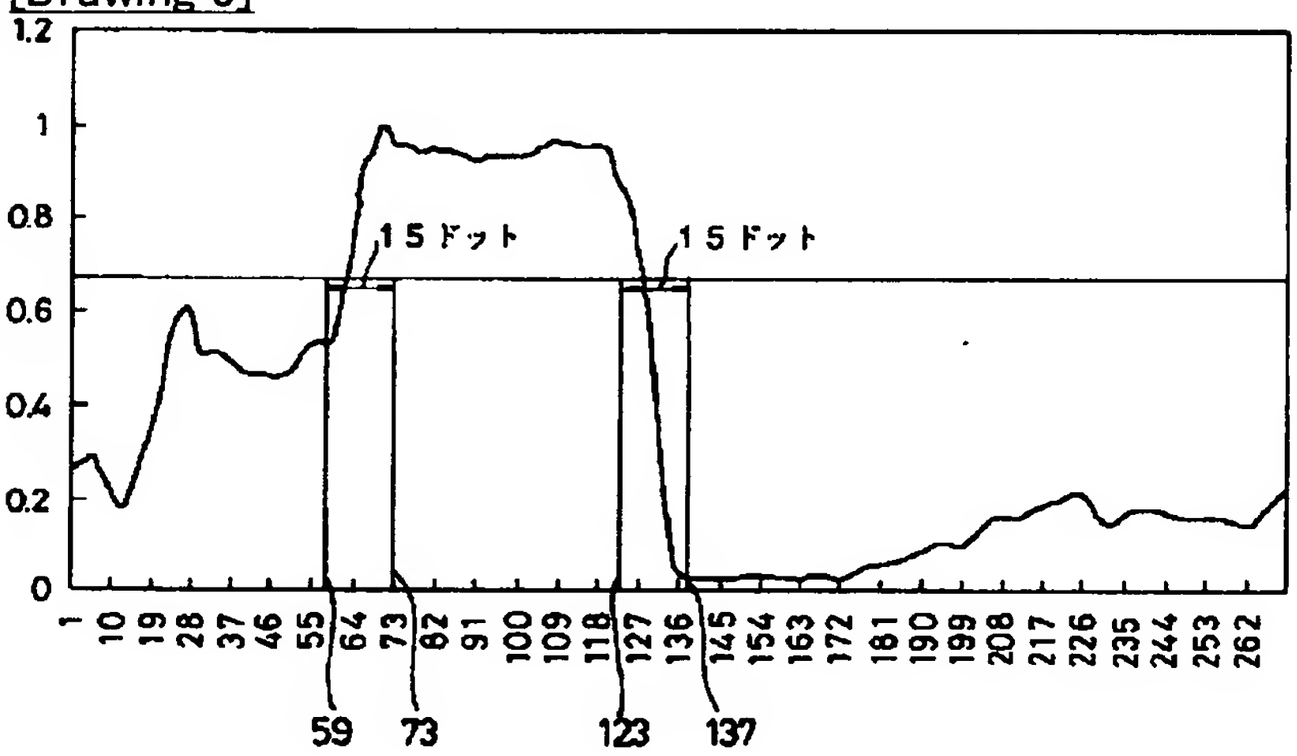
[Drawing 3]



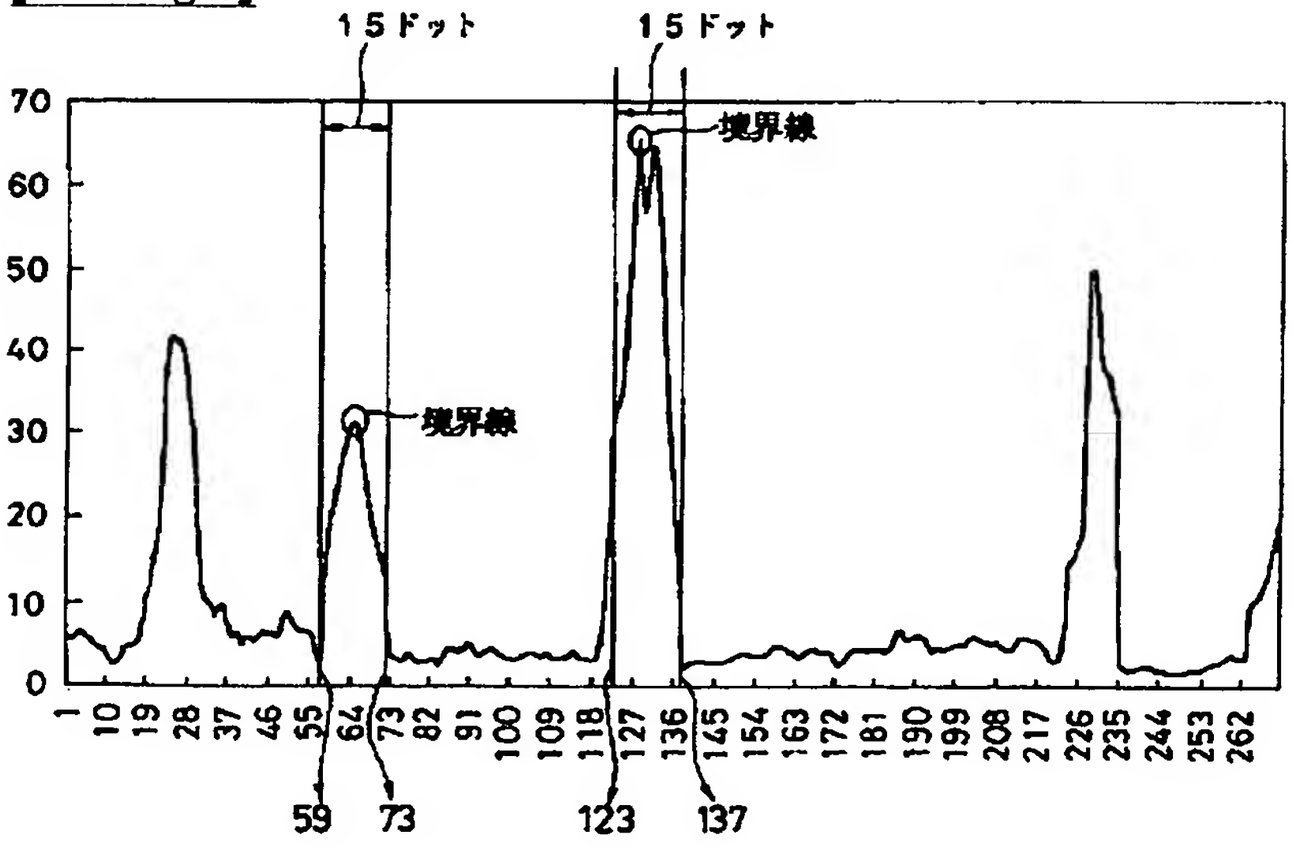

[Drawing 4]




[Drawing 5]




[Drawing 6]



[Translation done.]